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Bogda et al.

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[45] **Date of Patent: Jan. 9, 1990**

[54] **PROGRAMMER/TIMER WITH COMBINED LINE AND PROGRAM FUNCTION SWITCH**

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[73] Assignee: **Eaton Corporation**, Cleveland, Ohio

[21] Appl. No.: **281,572**

[22] Filed: **Dec. 8, 1988**

[51] **Int. Cl.**[4] **H01H 43/00**

[52] **U.S. Cl.** ..... **200/38 R**; 200/38 A; 200/38 B; 200/38 C

[58] **Field of Search** ..... 200/38 R, 38 A, 38 F, 200/38 FA, 38 FB, 38 B, 38 BA, 38 C, 38 CA

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,431,372	4/1969	Obermann	200/38 A
3,752,944	8/1973	Cartier et al.	200/38 C
3,866,002	2/1975	Underwood et al.	200/33 R
4,413,164	11/1983	Obermann et al.	200/38 R
4,497,985	2/1985	Courter et al.	200/38 R
4,497,986	2/1985	Zink et al.	200/38 R
4,560,846	12/1985	Klopp et al.	200/38 R

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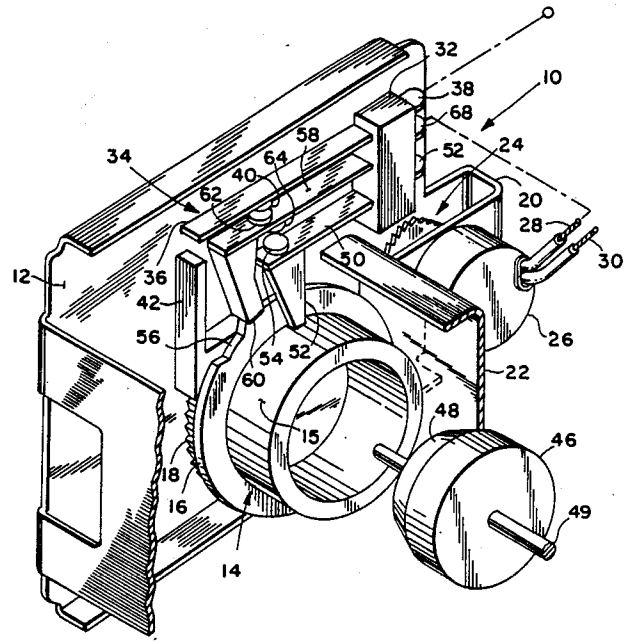
Attorney, Agent, or Firm—R. A. Johnston

[57] **ABSTRACT**

A combination programmer and line switch for an appliance having a rotary program cam and a timing motor connected for advancing the cam. An upper line power contact blade is moved between high and low positions by a manual actuator. A lower contact blade is maintained stationary and is adapted for connection to certain appliance load functions. An intermediate program contact blade series connected to the timing motor has a follower biased against the program cam and is adapted for connection to all appliance functions. With the upper contact in the high position, the motor circuit is open for all positions of the program and in the low position the timing motor is energized. Alternatively, the program cam may include a line contact switch override to maintain the intermedaite blade in contact with the upper blade for both positions of the manual actuator.

7 Claims, 4 Drawing Sheets



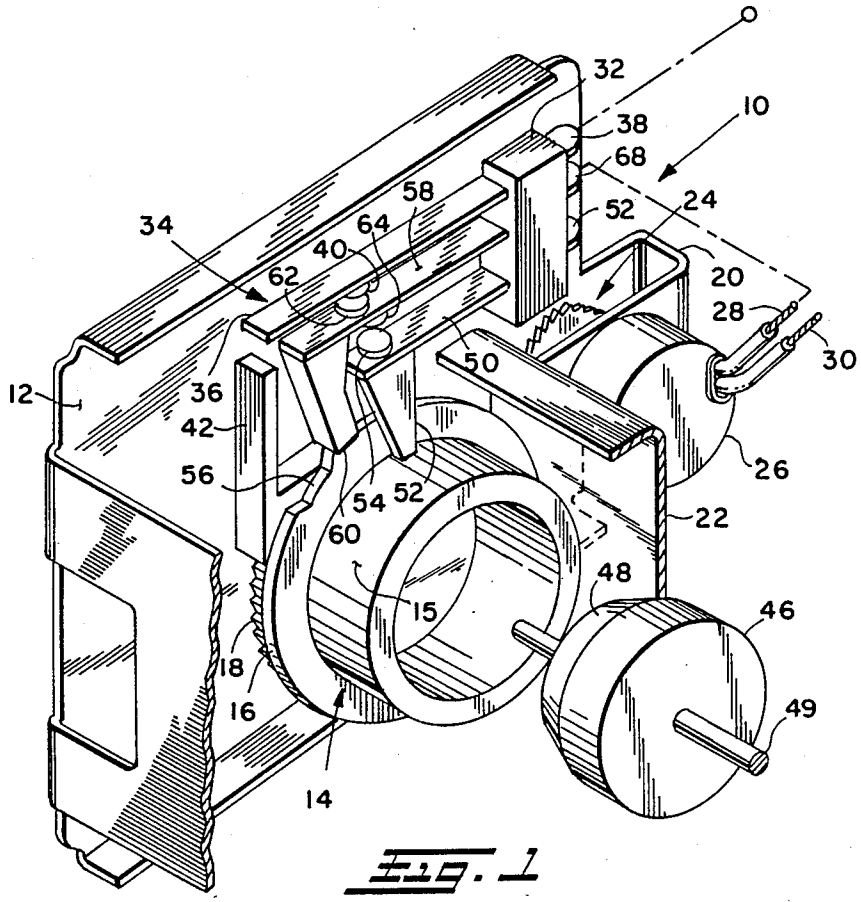

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Fig. 1

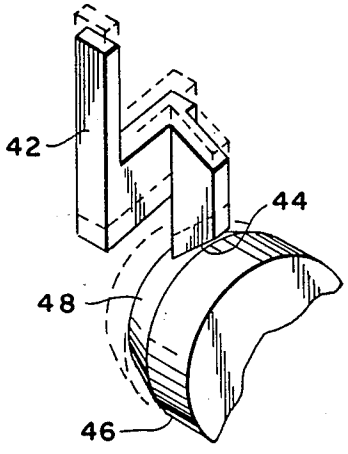
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Fig. 2

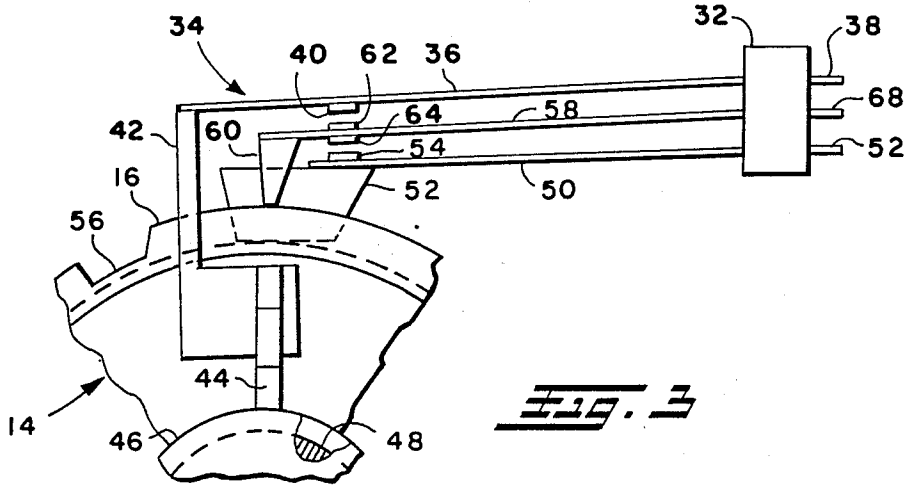


Fig. 3

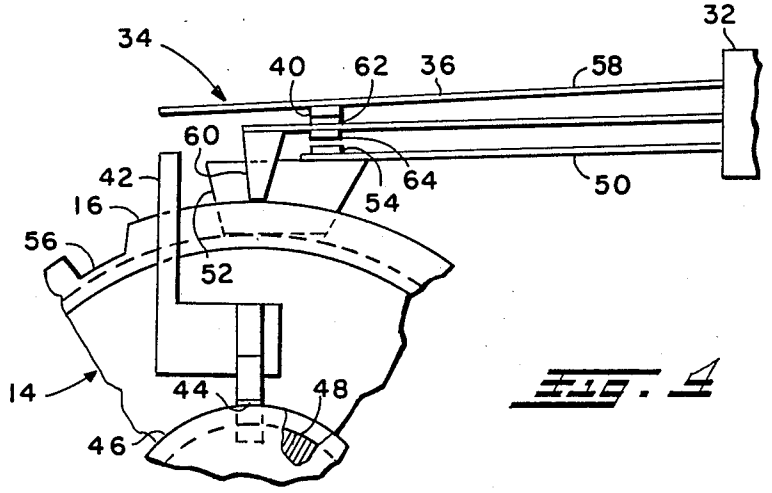


Fig. 4

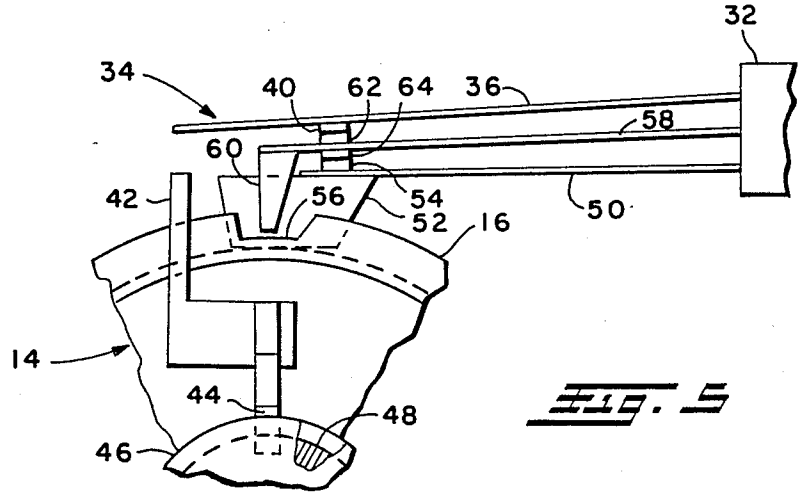
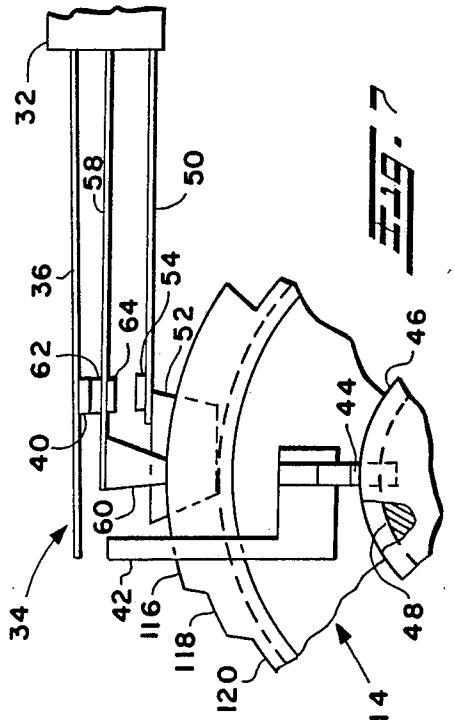


Fig. 5



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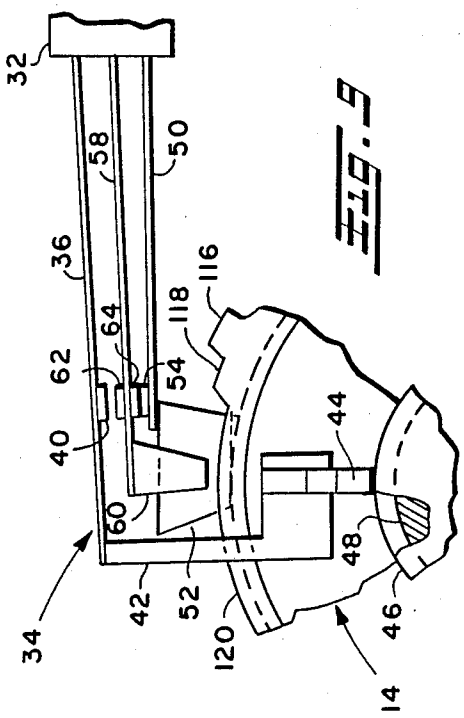

FIG. 9

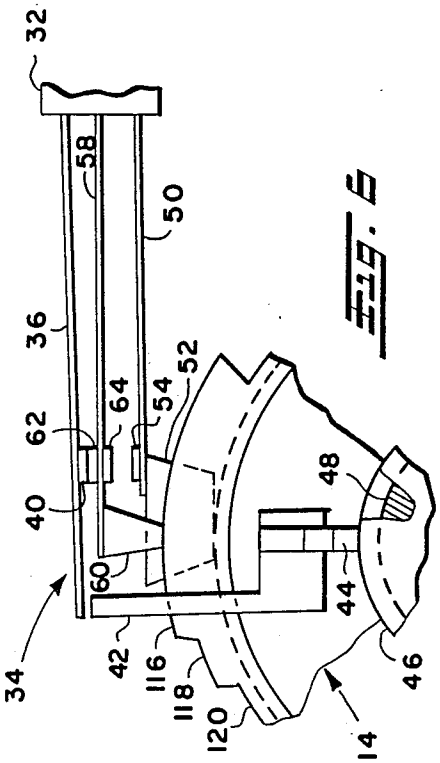

FIG. 6

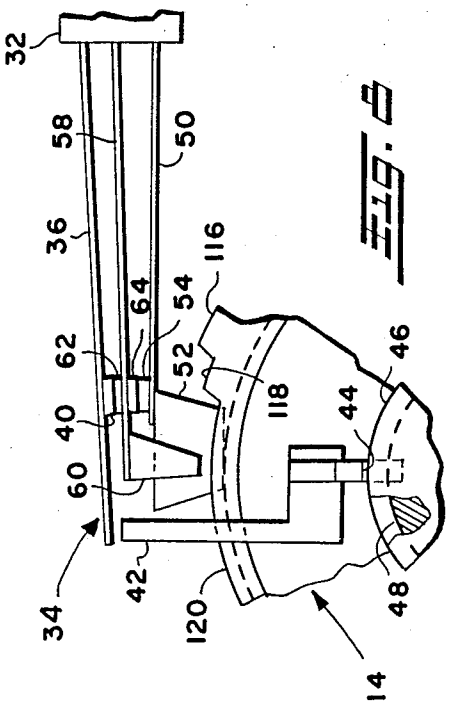

FIG. 8

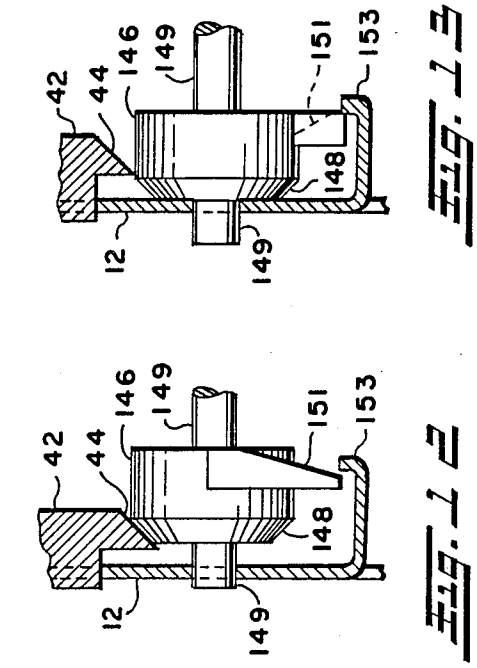

FIG. 13

FIG. 12

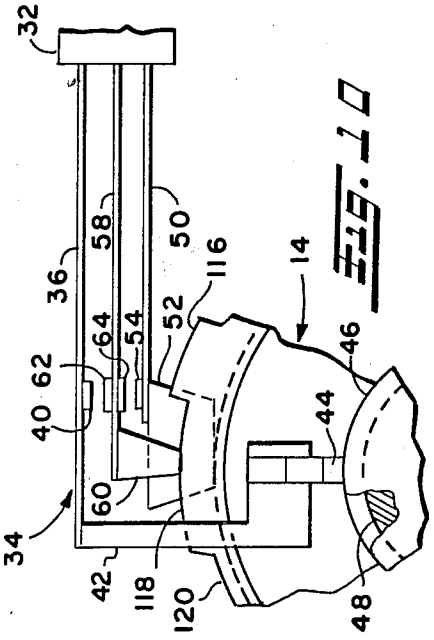

FIG. 10

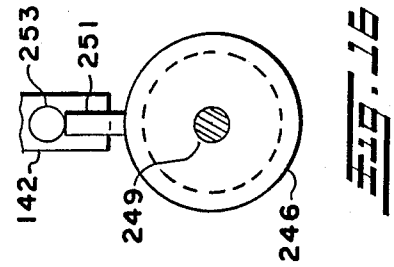

FIG. 16

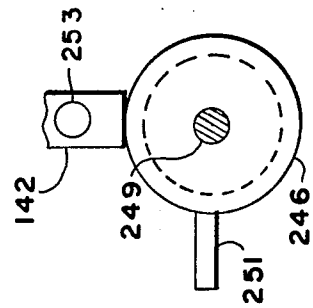

FIG. 15

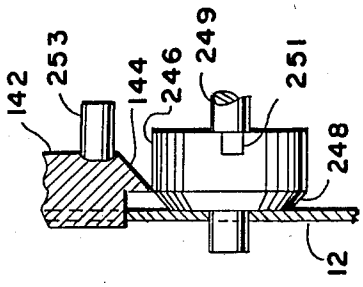

FIG. 14

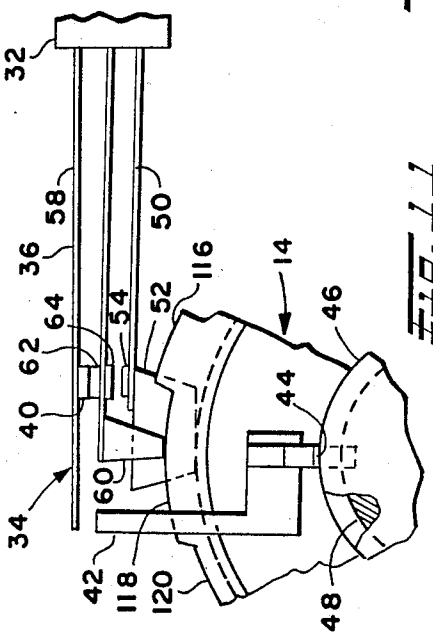

FIG. 11

PROGRAMMER/TIMER WITH COMBINED LINE AND PROGRAM FUNCTION SWITCH

BACKGROUND OF THE INVENTION

The present invention relates to electrical programmer/timers for appliances and particularly for household appliances such as washing machines, dishwashers and clothes dryers having user selected program intervals. Appliances of this type typically have a knob or dial rotated by the user for selection of the length of the appliance service program. The user rotates the dial to the selected dial position or mark for positioning a rotatable program cam operative to be advanced or rotated by a suitable timing mechanism such as a motorized speed reducer or periodically advanced pawl driving a toothed ratchet connected to the program cam and indexing the cam with each stroke of the pawl for timeout of the selected program interval. The program cam is typically contacted by a plurality of cam followers positioned thereabout for providing a desired sequence of operation to electrical function switches connected to each of the cam followers. The switches typically provide for the desired individual appliance functions such as controlling an electric water inlet valve, a water drain pump or drain valve, or an agitation and spin motor.

Programmer/timers of the above-described type are typically driven by a small subfractional horsepower synchronous timing motor which is connected to the appliance power line connector via a line switch. In some household appliance designs, it has been desired to provide actuation of the appliance line power switch by providing an axial movement to the program knob or dial for actuation of the line switch. Where space is at a premium for packaging the programmer/timer in the appliance control panel housing, the size of the program cam drum is limited, which in turn limits the number and size of cam actuated function or program switches that can be disposed about the cam drum for actuation thereby. It has therefore been desired to integrate the line function switch with the switches actuated by the program cam followers to conserve space and reduce manufacturing cost.

Where the appliance line power switch is combined with cam actuated switching functions, it has been found difficult to provide for separate user-actuation of the line power switch to retain user control of the appliance, and yet also provide for continuing power to the timing motor for advancing the cam to a desired position for restart after all other appliance functions have been disconnected by the power line switch.

It is known to provide an appliance programmer/timer having a rotary program cam for actuating a plurality of function switches wherein the line switch is combined with a program switch and the line switch is actuated by axial movement of the knob shaft for moving a slider to actuate the line switch. An example of such is described in U.S. Pat. No. 3,431,372 in the name of G. Obermann and in U.S. Pat. No. 4,497,985 in the name of Courter etal. However, the aforementioned programmer/timers having a combined program and line function switch do not provide for maintaining power to the timing motor irrespective of the position of the line switch actuator for certain positions of the program cam.

Thus, it has been desired to find a way or means of providing an appliance line switch combined with a cam operated program switch in a programmer/timer having rotary cam drum for actuating program function switches and to maintain power to the timing motor for certain positions of the program cam drum when the line switch is manually opened with the cam drum in such position.

SUMMARY OF THE INVENTION

The present invention provides a programmer/timer for an appliance such as household dishwashers, washing machines and clothes dryers and has a rotary program cam drum with a plurality of cam followers disposed thereabout each operative for actuating a machine function switch in a prescribed sequence as the cam drum is advanced by rotary movement. The cam advancement is provided by a synchronous timing motor connected via a speed reducer mechanism for driving an oscillating pawl which indexes the ratchet wheel connected to the program cam drum.

A line power and program function switch has a user-actuated axially moved cam member for contacting a slider member which is moved radially for actuating an upper line power switch contact blade which is disposed as the uppermost blade in a stack of at least three blades. A program switch contact blade which is the lowest of the stack has a stationary position and is adapted for electrical connection to certain machine functions. An intermediate switch contact blade has a cam follower provided thereon and is moved in response to the program cam for making and breaking a circuit with the upper line contact blade when a line switch actuator cam member is axially moved between the "ON" position and the "OFF" position. The intermediate contact blade is operative to make and break a circuit connection with the lower program blade only in response to movement of the program cam. When the line switch actuator cam is positioned to the "ON" position, the upper contact blade moves downward under self-bias to make contact with the intermediate contact blade to maintain line power to the timing motor and certain machine program functions for all positions of the program cam. In an alternative embodiment, the program cam is provided with sufficient lift in certain positions to maintain the intermediate contact blade against the line power contact blade when the line switch actuator is in the "OFF" position, for maintaining power to the timing motor for said certain positions of the program cam to provide continued timing motor operation for resetting the cam when the line power switch is opened by the appliance user to prevent subsequent restart with the cam in an undesired position.

The present invention thus provides a low cost compact programmer/timer for a household appliance and employs a rotary program cam with a line power switch combined with one of the program switches to provide for maintaining power to the cam advance motor when the program switches are open. The present invention thus provides for line switch and program function switching in a single combined switch start actuated by a single cam track. In the present invention the user also provides line switch actuation by axial movement of a line switch actuator cam connected to the rotary selector knob. Alternatively, axial movement of the line switch actuator cam may be affected by an auxilliary cam which follows a stationery projection when the program cam is rotated to a certain position by the advance mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a somewhat perspective of the programmer/timer of the present invention with portions of the housing removed;

FIG. 2 is an enlarged view of a portion of the line switch actuator of FIG. 1;

FIG. 3 is a front view of the combined line/program switch of FIG. 1 with the line switch actuator in the "OFF" position and the switches in the open circuit condition;

FIG. 4 is a view similar to FIG. 3 with the line switch actuator in the "ON" position, the line switch closed and the program switch open circuit;

FIG. 5 is a view similar to FIG. 4 with the program cam rotated to a position closing the program switch;

FIG. 6 is a view similar to FIG. 3 and shows the line switch actuator in the "OFF" position with the program maintaining the line switch closed;

FIG. 7 is a view similar to FIG. 6 with the line switch actuator in the "ON" position and the cam maintaining the line switch closed;

FIG. 8 is a view similar to FIG. 7 with the line switch actuator in the "ON" position and the cam rotated to a position closing the program switch;

FIG. 9 is a view similar to FIG. 8 with the program cam in the same position as FIG. 8 but with the line switch actuator in the "OFF" position opening the line switch;

FIG. 10 is a view similar to FIG. 9 with the line switch actuator in the "OFF" position and the cam rotated to a position maintaining both line and program switches in the open circuit condition;

FIG. 11 is a view similar to FIG. 10 with the cam positioned in the same position as FIG. 10 but with the line switch actuator the "ON" position closing the line switch;

FIG. 12 is a view of an alternate embodiment of the line switch actuator cam illustrated in the "OFF" position;

FIG. 13 is a view similar to FIG. 12 showing the line switch actuator in the "ON" position;

FIG. 14 is a view similar to FIG. 12 showing another embodiment of the line switch actuator cam;

FIG. 15 is a right-hand view of the embodiment of FIG. 14 with the line actuator cam in the "ON" position; and

FIG. 16 is a view similar to FIG. 15 with the line switch actuator cam in the "OFF" position.

DETAILED DESCRIPTION

Referring to FIGS. 1 and 2, the programmer/timer is indicated generally at 10 and has a housing or deck plate 12 upon which is mounted a program cam 14 journaled on housing 12 and which has thereon a cam track 16 and an advance ratchet wheel having teeth 18 thereon for rotation with the cam 14. Auxiliary support bracket with arms 20, 22 is attached to the deck plate 12 by suitable means as for example, twist-tabs (not shown). A suitable gear reduction indicated generally at 24 is driven by a timing motor 26 mounted on the exterior of bracket arm 20. Motor 26 has its shaft engaging the gear box 24 through bracket arm 20 and the motor 26 has a pair of electrical leads 28, 30 adapted for attachment to a line switch as will hereinafter be described.

The ratchet wheel teeth 18 are driven by an oscillating pawl (not shown) which interconnects the gear box 24 with the ratchet teeth for indexing the cam 14 in a manner well known in the art, the details of which have been omitted for the sake of brevity.

Deck plate 12 has mounted thereon an insulator block 32 which has molded therein and extending outwardly therefrom in spaced generally parallel cantilevered relationship a plurality of stacked switch contact blades comprising a combination line and program switch assembly indicated generally at 34. The combination switch has an upper contact blade 36 which extends the furthest distance from block 32 and which has a terminal portion 38 extending through the block 32 and outwardly therefrom for electrical connection to one side of a power line. The line switch contact blade 36 has provided on the lower face thereof a suitable button contact 40 which is adapted for making and breaking a circuit upon movement of the blade 36. Disposed adjacent the lower face of the line switch contact blade 36 near its free end is a line switch actuator 42 which is suitably mounted on deck plate 12 for sliding movement in the vertical direction. Line switch actuator 42 has an inclined cam surface 44 provided thereon which contacts a corresponding surface 48 provided on an axially movable cam member 46. Cam member 46 has a shaft extending therefrom which is received in cam 14 for axially sliding movement therein by the appliance user. Axial movement of cam member 46 is effective to cause movement of line switch actuator 42 from the position shown in solid outline in FIG. 2 to the position shown in dashed outline. It will be understood that shaft 49 although axially moveable is engaged with cam drum 14 for rotation therewith by any suitable means such as a clutch, flats on shaft 49 (not shown) or other technique well known in the art.

A lower program contact blade 50 is mounted in and extends from insulator block 32 in cantilever arrangement with the free end thereof having a follower 52 thereon for contacting a level surface 15 of the cam drum for stationary location with respect to the drum surface as a datum from which the cam track 16 is located. The program blade 50 has an electrical contact 54 disposed on the upper surface thereof with reference to lower program contact blade 50 has a connector portion 52 thereof extending through insulator block 32 and adapted for electrical connection to various desired appliance load functions.

An intermediate program blade 58 is disposed between upper blade 36 and the lower blade 50, the intermediate blade extending in cantilever from insulator block 32 in spaced generally parallel relationship with blades 36 and 50. Intermediate blade 58 has a cam follower 60 provided at the free end thereof which follower is self-biased by the blade 58 to ride on cam track 16. The intermediate blade 58 has an upper contact 62 which is aligned vertically with the contact 40 on the line switch contact blade; and, blade 58 has a lower contact 64 disposed on the undersurface thereof and aligned with the contact 54 on the lower program blade. An electrical connector portion 68 of blade 58 extends through block 32 and externally thereof for connection to motor lead 28 as indicated in FIG. 1 by dashed line.

Rotation of the cam 14 causes the follower 60 to rise and fall in accordance with the contour of the cam track 16 thereby raising and lowering intermediate blade 58 for moving contact 64 between an open and closed position with respect to the lower contact 54 for making and breaking a circuit between the connector terminals 52, 68. It will be understood that upon closure of the contact pair 62, 40 between the intermediate blade and

the upper line power contact blade, line power is connected to motor **26**.

Referring to FIGS. **1** through **5**, the cam drum **14** is shown in a position wherein the cam follower **60** is raised to ride on cam track **16** wherein the intermediate blade **58** is raised and maintained in a position to open the contact set **54, 64** between the intermediate blade **58** and the lower blade **50**, thus breaking circuit connections for the selected appliance functions.

In FIG. **3**, the line switch actuator **42** is shown in the raised or uppermost position limit of its travel wherein the follower **44** is riding on the outer diameter **46** of the actuator member. In the position shown in FIG. **3**, the line switch actuator **42** has raised the upper line power contact blade **36** to a position wherein contacts **40, 62** are broken thereby cutting off line power to the timing motor **26** and all other appliance functions. In the condition of switch combinations **34** shown in FIG. **3**, the cam drum **14** is immobilized because the timing motor is inactivated.

Referring to FIG. **4**, the switch combination **34** is changed although the cam with same position of FIG. **3** is illustrated, but with the line switch actuator **42** dropped to the lower position wherein the camming surface **44** thereon is released from the outer diameter **46** of the axially movable actuator member to ride on the cam surface **48** (FIG. **2**). In the position shown in FIG. **4**, the line switch actuator has permitted the upper contact blade **36** to drop under its self-bias until the contact set **40, 62** has closed thereby providing current to flow through contact blade **58** and its connector **68** to the timing motor **26** for continuing advancement of cam **14**. In the position shown in FIG. **4**, the line switch actuator members **42** and **46** are considered to be in the "ON" position (shown in solid outline in FIG. **2**).

Referring to FIG. **5**, switch combination **34** is shown in a condition wherein cam track **16** is no longer beneath follower **60** which has dropped into the depression **56** formed in the cam track **16**. In the position shown in FIG. **5**, the line switch actuator **42** is maintained in the "ON" position (shown in solid outline in FIG. **2**) as in FIG. **4**; and, the contact blade **58** has dropped to close the lower set of contacts **64, 54** with and the line power blade self bias maintaining the contact pair **40, 62** closed. In the switch position shown is FIG. **5** both sets of contacts are closed and power is provided to the machine functions through the lower set of contacts and to the timing motors through the upper set of contacts.

Referring to FIGS. **6–11**, an alternative embodiment of the programmer cam track **116** is illustrated as having an intermediate step down level **118** and a lower level **120**. With reference to FIG. **6**, the line switch actuator members **46, 42** are shown in the "OFF" position wherein the cam surface **44** on the actuator **42** is riding on the large diameter **46** of the axially movable actuator member. In the condition of switch combination **34** shown in FIG. **6**, cam track surface **116** has raised the cam follower **60** closing contacts **62 40** thereby maintaining power to the timing motor and the lower contact set **64, 54** is broken, thereby terminating current flow to the appliance program functions. Thus, it will be seen that in the switch condition shown in FIG. **6** the cam track **116** maintains power to the timing motor despite the user movement of the line actuator to the "OFF" position.

Referring to FIG. **7**, a changed condition of switch combination **34** is shown wherein the cam track **116** is maintained in the same position as shown in FIG. **6**; however, the line switch actuator **42** has been dropped to the lower or "ON" position by moving the member **46** axially until the cam surface **44** has dropped onto the cam surface **48** (see FIG. **2**). In the condition of FIG. **7**, switch **34** has the line power contact blade **36** biased downwardly to close the contact sets **40, 62** maintaining power to the timing motor. With reference to FIGS. **6** and **7** it will be seen that irrespective of the position, e.g. "OFF" or "ON", of line switch actuators **46, 42** contacts **40, 62** are closed and power to the timing motor is continued; whereas, the lower set of contacts **64, 54** is broken.

Referring to FIG. **8**, the line switch actuator member **42** is maintained in the lower position as described with respect to FIG. **7**; however, the cam **14** has been rotated until the cam follower **60** is disposed above portion **120** of the cam track. In the cam track position shown in FIG. **8**, blade **58** has dropped to close the lower contact set **64, 54** for providing power to the selected appliance functions, while the upper contact set **62, 40** is maintained closed for continuing power to the timing motor.

Referring to FIG. **9**, the cam **14** and track portion **120** are maintained in the same position as illustrated in FIG. **8**, the lower contact set **64, 54** is maintained closed; however, the line switch actuators **42, 46** have been moved to the "OFF" position and raising contact blade **36** and no power flows through the contacts **54, 64** because line power has been broken by the upper set of contacts.

Referring to FIG. **10**, the cam **14** has been rotated to a position wherein the intermediate level **118** of cam track is lifting the cam follower **60** and intermediate contact blade **58** to a open switch condition. The line switch actuator **42** has been moved to the raised or "OFF" position wherein blade **36** has been raised to break contacts **40, 62**.

Referring to FIG. **11**, the program cam track has been maintained in the same position as in FIG. **10**; however, the line switch actuator member **42** has been dropped by axial movement of the member **46** to cause cam surface **44** to drop onto the cam **48** as shown in solid outline. With the line switch actuator in the position shown in FIG. **11**, the self-bias of blade **36** has closed the contacts **40, 62** while the lower contact set is maintained broken for preventing current flow to the appliance functions. Thus, it will be seen that the intermediate cam track surface **118** is operative to effect opening and closing of the circuit to the timing motor.

Referring to FIGS. **12** and **13**, an alternative version of the line switch actuator is shown wherein the cam member **146** has a conical or chamfered auxilliary camming surface **148** thereon which contacts the vertical slider member **42** for actuating the upper contact blade **36**. The cam member **146** is supported by shaft **149** which is journaled at one end in the deck plate **12** and has the opposite end shown truncated in FIGS. **12** and **13**, but actually extending outwardly for user actuation via a knob (not shown).

Cam member **146** has provided thereon an auxiliary helical cam surface **151** which contacts a tab or lug **153** formed on the deck plate for automatically providing leftward axial movement of the cam member **146** upon rotation of the member **146** by shaft **149** due to the rotational coupling of the shaft **149** with cam drum **14**. With reference to FIG. **12**, the auxiliary cam **151** is shown in the "ON" position with the cam member **146** moved axially rightward by user movement of shaft **149**

permitting rightward movement for camming slider **42** to be moved vertically downward for enabling moving the contact blade member **36** to move to the position contacting blade member **58** to close contact **40, 62.**

Referring to FIG. **13**, cam member **146** has been rotated by the cam drum **14** approximately one-quarter turn counterclockwise, as viewed from the right side in FIG. **12**, to a position where auxiliary cam surface **151** has acted against the end of the lug **153** to cause diagonal sliding contact between cam surface **148** and surface **44** thereby raising the slider **42** and positioning the line switch blade **36** in the position breaking the circuit between contacts **40, 62.** The version shown in FIGS. **12** and **13** thus incorporates an automatic appliance shut-off at the end of the program or where the user has manually rotated shaft **149** to position member **146** and surface **151** to the position shown in FIG. **13.**

Referring to FIGS. **14** through **16**, a further alternative version of the line switch actuator mechanism is illustrated where a cam member **246** has shaft **249** extending in opposite directions therefrom, with one end journaled in plate **12** and the other end in the direction opposite the plate **12** for user actuation, but shown truncated. The member **246** has a conical or chamfered auxiliary cam surface **248** provided on the axial end thereof adjacent plate **12** and a lug **251** extending radially outwardly from the outer diameter thereof. The line switch actuator slider **142** has provided thereon a projection **253** which has a generally cylindrical configuration to provide a camming action upon rotation of the cam member **246** to a position such that the end of the projection **251** engages the cylindrical surface of the member **253.** Rotation of the member **246** by user rotation of shaft **249** one-quarter turn counterclockwise from the FIG. **15** position as shown in FIG. **16** raises slider **142** to its vertically upward position thereby raising line switch contact blade member **36** to the "OFF" position.

The present invention thus provides a programmer/-timer for an appliance wherein the line power switch for controlling power to the timer motor for advancing the program cam drum and all of the machine functions is combined with a program switch for controlling selected machine functions in response to cam drum rotation. A user operated actuator permits the appliance user to selectively open and close the line power switch during operation of the machine program.

The present invention provides for a single switch start which combines line power switching with selected program switching in response to a follower on a single program cam track. In one embodiment, the program cam maintains power to the timing motor to advance the cam when the user opens the line power switch with the program cam in certain positions to stop the main appliance functions. Continued rotation of the cam by the advance mechanism advances the cam to provide certain function positions desirable for restart upon the user closing the line power switch.

Although the present invention has hereinabove been described with respect to the illustrated embodiments, it will be understood that the invention is capable of modification and variation and is limited only by the following claims.

We claim:

1. A combination electrical programmer timer and line switch assembly for an appliance comprising:

(a) housing means;

(b) a program cam mounted for rotary movement on said housing means;

(c) timing motor means associated with said housing means and operable upon energization to effect said movement of said program cam;

(d) a first movable line switch contact blade mounted on said housing means for connection to one side of a power line;

(e) actuator means movably mounted on said housing means and including auxiliary cam means contacting a movable member operable upon user manual movement to move said movable member for moving said movable first contact blade between a first (low) and second (high) position;

(f) a stationary contact blade mounted on said housing means for series connection with certain appliance functions;

(g) an active program switch contact blade disposed on said housing means between said first movable line contact blade and said stationary blade, said program switch blade including a cam follower contacting said program cam, said program switch blade series connected with said motor means for series connection with all of said appliance functions, wherein said line contact blade in said high position prevents energization of said motor for any position of said cam follower on said programmer cam and in said first (low) position, maintains said motor energized for all positions of said cam follower on said program cam.

2. The combination defined in claim **1**, wherein said actuator is user movable between a first position lowering said line switch blade toward said program cam and a second position raising said line switch blade further from said program cam.

3. The combination defined in claim **1**, wherein said actuator means includes a cam member movable in an axial direction with respect to rotation of said program cam and a second member movable in a radial direction for contacting said line contact blade.

4. The combination defined in claim **1**, wherein said actuator means is operable to move said line switch contact blade between a first (low) position to a second (high) position, said actuator means operable in said first position to maintain said line switch contact blade in closed circuit contact with said program contact blade energizing said motor means for all positions of the program cam and operable in said second position to maintain said line switch contact blade in open circuit position with respect to said active program blade deenergizing said motor means for all positions of said program cam.

5. The combination defined in claim **1**, wherein said actuator means is movable in response to user actuation, between a first (low) position and a second (high) position, wherein said line switch contact blade in said first position maintains a closed circuit with said active program blade for all positions of said cam and a second (high) position wherein said active blade in said second position opens the circuit with said line switch contact blade for certain positions of said program cam, and is in open circuit with said line switch contact blade for other positions of said program cam, said actuator means in said first (low) position maintains said active program contact blade in closed circuit relationship with said line switch contact blade and said timing motor means energized for all positions of said program cam.

6. The combination defined in claim 1, wherein said actuator means includes selector cam means operable drum user rotation to effect movement of said actuator means between said first (low) and said second (high) position.

7. The combination defined in claim 1, wherein said program cam is operative in certain selected positions to maintain said program contact blade in closed circuit contact with said line contact blade for both of said high and low positions of said actuator means.

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